PATENT CLAIMS

Sub A1

1. A fiber-optic pressure sensor (1, 25), in particular suitable for measuring differential pressures and flow rates in oil drill holes, comprising a transducer (1) with a sensor fiber (2) which has at least one fiber Bragg grating (3, 4, 5), characterized in that
   a) the transducer (1) comprises at least one first pressure member (7a) for holding a first medium (11a) under an all round pressure p_1,
   b) the transducer (1) comprises at least one second pressure member (7b) for holding a second medium (11b) under an all round pressure p_2, and
   c) the transducer (1) is configured for measuring a pressure difference p_1-p_2 by converting the all round pressures p_1, p_2 into a longitudinal elongation or compression of the at least one fiber Bragg grating (3, 4) of the sensor fiber (2).

2. The fiber optic sensor (1, 25) as claimed in claim 1, characterized in that the transducer (1) is configured for a differential elongation of the fiber Bragg grating (3, 4) induced by the pressure difference p_1-p_2.

3. The fiber optic sensor (1, 25) as claimed in one of claims 1-2, characterized in that
   a) the sensor fiber (2) is mounted between holders (6a, 6b, 6c; 15b) and preferably prestressed,
   b) the holders (6a, 6b, 6c; 15b) are connected in a force-closed fashion to the pressure members (7a, 7b) and, if appropriate, to supporting members (15a), and

c) the pressure members (7a, 7b) are configured to deflect at least one holder (6a, 6b, 6c) as a function of the pressures p_1, p_2.

4. The fiber optic sensor (1, 25) as claimed in claim 3, characterized in that
a) exactly two cylindrical pressure members (7a, 7b) are provided, which are arranged concentrically, in parallel or serially relative to one another,
b) the pressure cylinders (7a, 7b) have the same length L and
c) the holders (6a, 6b, 6c) are fastened on plunger faces (8, 8a, 8b) of the pressure cylinders (7a, 7b).

5. The fiber optic sensor (1, 25) as claimed in one of claims 1-4, characterized in that
a) the transducer (1) has separate inlets (10a, 10b) for the media (11a, 11b) into the pressure members (7a, 7b) and/or
b) a fiber Bragg grating (3) is provided for differential pressure measurement, a fiber Bragg grating (4) is provided for error compensation, and/or a fiber Bragg grating (5) is provided for temperature measurement.

6. The fiber optic sensor (1, 25) as claimed in one of claims 1-5, characterized in that
a) a fiber Bragg grating (3) is held (6a, 6b) between the first and second pressure members (7a, 7b) for the purpose of differential pressure measurement, and
b) in particular, an error compensation fiber Bragg grating (4) is held (6a, 6c) between the second and first pressure members (7b, 7a) in reverse sequence for the purpose of antiphasal change in elongation.

7. The fiber optic sensor (1, 25) as claimed in one of claims 1-6, characterized in that
   a) a fiber Bragg grating (3) is held (6a, 15b) between a holder (6a), which can be deflected by differential pressure of two pressure members (7a, 7b), and a supporting member (15a), the holder (6a) preferably being connected to a common end plate (8) of two serially arranged pressure members (7a, 7b) and
   b) in particular, an error compensation fiber Bragg grating (4) is held (6a, 15b) between the supporting member (15a) and the holder (6a) which can be deflected by differential pressure in reverse sequence for the purpose of antiphasal change in elongation.

8. The fiber optic sensor (1, 25) as claimed in one of claims 1-7, characterized in that
   a) one fiber Bragg grating (3) each is held (6a, 15b) between a first pressure member (7a) and a supporting member (15a) and a second pressure member (7a) and a supporting member (15a), and
   b) a pressure difference can be determined with the aid of the two fiber Bragg gratings (3, 4).

9. The fiber optic sensor (1, 25) as claimed in one of claims 1-8, characterized in that
   a) at least one pressure member (7a, 7b) and/or at least one supporting member (15a) consists of, or is assembled from materials with different coefficients of thermal expansion α_1, α_2, such that a differential thermal expansion between the holders (6a, 6b, 6c) counteracts a thermally induced displacement of a Bragg wavelength (λ_B) of the sensor fiber (2), and

b) in particular, a pressure or supporting member (7a, 7b, 15a) is assembled from at least two segments with different coefficients of thermal expansion and prescribable lengths L', L''.

10. The fiber optic sensor (1, 25) as claimed in one of claims 1-9, characterized in that
a) the transducer (1) has pressure-tight fiber bushings (12a, 12b) for the sensor fiber (2), and/or
b) the transducer (1) has a cavity (13) for a fiber Bragg grating (5) for the purpose of temperature measurement, and/or
c) at least one block with a bore for laterally supporting the sensor fiber (2) is provided in the region of a fiber Bragg grating (3, 4) for the purpose of a compression arrangement.

11. The fiber optic sensor (1, 25) as claimed in one of claims 1-10, characterized in that a plurality of transducers (1) of different Bragg wavelength λ_B are optically connected to a broadband light source (16) and, preferably via a fiber coupler (18) to a wavelength-division demultiplexer (19) and a detector plus an electronic measuring system (20).

12. Use of a fiber optic differential pressure sensor (1, 25) as claimed in one of claims 1-11, characterized in that
a) a flow rate v_1 of a fluid flow (24) is determined from a differential pressure measurement, and
b) in particular, the differential pressure measurement is carried out at a venturi tube (23).